BELLCOMM, INC.
1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: Trip Report - Chrysler "Saturn IB Improvement Study" Review Briefing at Manned Space Flight Center, Huntsville, Alabama on September 7, 1967 - Case 103-2

DATE: October 12, 1967

FROM: A. E. Marks

ABSTRACT

Chrysler presented a second quarter review of its "Saturn IB Improvement Study," NAS8-21107, at MSFC, on September 7, 1967. This briefing was concerned mainly with the control characteristics of the candiate vehicle configurations. Discussed herein are the highlights of this review briefing.

(NASA-CR-90829) TRIP REPORT - CHRYSLER "SATURN 1B IMPROVEMENT STUDY" REVIEW BRIEFING AT MANNED SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA ON SEPTEMBER 7, 1967 (Bellcomm, Inc.) 3 p

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MEMORANDUM FOR FILE

A second quarter review briefing on the "Saturn IB Improvement Study," NAS8-21107, was presented by Chrysler at MSFC on September 7, 1967. Three vehicle configurations are being studied: (1) a standard Saturn IB with stretched tanks (MLV-SAT-IB-CORE), (2) an S-IB with two 120-inch solid rocket motor (SRM) strap-ons (MLV-SAT-IB-13.7B), and (3) an S-IB with four 120-inch SRM strap-ons (MLV-SAT-IB-11.7B). For each configuration, two payload shapes are being evaluated: one with the standard Apollo payload shroud, and the other with a standard NASA 260-inch payload shroud. The MLV-11.7B and 13.7B vehicles differ from the more fully studied A configurations in that the B-SRM's are 7-1/3 segment motors as compared to 7 segments for the A's. This review was mainly concerned with the flight control characteristics of these modified launch vehicles.

The flight performance ground rules were 72-degree launch azimuth from KSC, 105 nautical mile circular orbit, direct ascent and injection, Patrick Air Force Base (PAFB) atmosphere, and fuel ΔV reserve of 0.75 percent of the vehicle ideal velocity. Preliminary performance evaluation yielded payloads on the order of 118,000 pounds for the MLV-11.7B, 87,000 pounds for the MLV-13.7B, and 36,000 pounds for the core vehicle. In all cases, the maximum dynamic pressure and acceleration were well within tolerable limits. It should be noted that the present J-2 engine, not the J-2S engine, was used in this study.

The major conclusions to be drawn from this briefing are:

1. Under maximum wind load conditions, the MLV-13.7B with the 260-inch payload shroud has thrust vector control (TVC) requirements which exceed the present capability of the vehicle. With the four outboard H-1 engines and the two SRM's providing the TVC, gimbal angles of 9.1 degrees for the H-1's and 5.9 degrees for the SRM's are required; the maximum attainable gimbal angles being 8.0 degrees and 5.2 degrees, respectively.

2. The relative acceleration for crew abort shortly after lift-off is marginal, less than one g, for both the SRM-assisted boosters.

Chrysler will spend some additional time next study period to solve the TVC problems. Some possible solutions to be considered will be extending the H-1 maximum gimbal angle to 10 degrees, and possibly using a different type of attitude sensing and correction logic.

More detailed information on the control studies, TVC calculations, and vehicle design modifications are included in an unclassified brochure. This can be obtained by contacting the author.

A. E. Marks

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